UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
166 Water Street
Woods Hole, MA 02543

March 29, 2001

CRUISE RESULTS

NOAA Fisheries Research Vessel DELAWARE II
Cruise DE 01-01

Small Pelagics Hydroacoustic Survey

CRUISE PERIOD AND AREA

The cruise period was originally scheduled from February 5 - 23, 2001. The FRV Delaware departed from Northeast Fisheries Science Center (NEFSC) in Woods Hole, Massachusetts two days late on February 7 due to strong winds. Acoustical calibrations were completed at the pier of the Woods Hole Oceanographic Institute during February 5 - 6. Cruise operations were conducted on the continental shelf between water depths of 40 and 360 m in the southern New England region (Fig. 1). The FRV Delaware arrived two days early in Woods Hole on February 21 due to windy conditions.

OBJECTIVES

The cruise objectives were to (1) calibrate the EK500 Scientific Echo-Sounder, (2) conduct a fisheries acoustic systematic survey along the continental shelf of the southern New England region, (3) ground-truth species-specific acoustic estimates with midwater trawling and underwater video operations, (4) locate pelagic single-species aggregations of Atlantic mackerel, silver hake, *Loligo* squid, *Illex* squid, and butterfish for *in-situ* multi-frequency target strength (TS) experiments to define the variability of their acoustic measurements.

METHODS

EK500 Calibrations:

Fisheries acoustics is an internationally accepted method for estimating the abundance of pelagic fish and squid populations. The multifrequency Simrad EK500 (v.5.30) Scientific Echosounder system was the primary instrumentation used during this cruise to estimate the abundance of pelagic fish and squid. Calibrations of the EK500 transducers are critical to ensure that the echo-integration system is operating properly and for accurate acoustic measurements.

The FRV Delaware's EK500 operates three downward looking hull-mounted transducers (one single-beam transducer operating at 12 kHz, and two split-beam transducers at 38 and 120 kHz). The 38 and 120 kHz split-beam transducers were calibrated dockside using the standard sphere technique, while the single-beam 12 kHz transducer could not be accurately calibrated. The transceiver test menu was checked before calibration (and during the cruise) to ensure the EK500 instrument and transducer connections were operating properly. A calibration sphere of known target strength (-33.6 dB for the 38 kHz and -40.4 dB for the 120 kHz) was suspended about 10 m under each transducer. Each sphere was moved at a constant depth throughout the beam pattern using three remotely controlled downriggers. The TS gain for the 38 and 120 kHz transducers were derived using the Simrad Lobe (v.95-01-17) program. Upon deriving the beam pattern and TS gain parameters, the calibration sphere was centered for deriving the Sv gain using the integration tables.

Fisheries Acoustic Survey Operations:

This cruise was the first NEFSC fisheries acoustic survey conducted on the continental shelf in the southern New England region during February. A systematic survey design of evenly spaced parallel transects was surveyed along the continental shelf in the southern New England region (Fig. 1). The survey area was delimited by the 50 and 400 m bathymetric contours. Each transect was defined as a continuous cruise track with a single heading and constant ship speed, and was sequentially numbered. The parallel transects were orientated from north to south. The perpendicular cruise tracks to move between the parallel transects were referred to as crossover transects which are generally not used for abundance estimates. The last transect was conducted from east to west, and then west to east across an aggregation of Atlantic herring to obtain individual target strength measurements (Fig. 1).

Survey operations included continuous data collection from the multifrequency EK500 scientific sounder, omni-directional sonar, and Scientific Computer System (SCS) throughout the cruise track and during gear deployments. Vessel speed during survey operations was maintained at 10 ± 1 knots depending on weather conditions. Conductivity-temperature-depth (CTD) profiles were routinely taken at the waypoints of each transect and before gear deployments to define the hydrographic structure of the study area. Water bottle samples were collected once per day for salinity calibration. Midwater trawl and underwater video deployments were conducted intermittently along transects to identify selected acoustical backscatter and collect biological samples. Biological samples were collected and processed according to standard NEFSC procedures.

A newly installed Simrad EQ50 operating at 50 and 200 kHz was used throughout the cruise operations. Although the EQ50 does not have digital output, the acoustic echogram information was evaluated for scientific application.

After each gear deployment, the resumed transect was assigned the same number if the vessel maintained the same cruise track heading and speed at the same location where the previous track ended. The transect number was incremented when the vessel heading changed or the vessel did not resume near the end of the previous track. Sequential deployment numbers were assigned for each time any gear was deployed. All sampling events (deployments and waypoints of transects) were logged using the Delaware's Scientific Computer System (SCS) Event Logger program to provide effective data management between the acoustical and deployment data sets.

EK500 Sampling Operations and Post-Processing:

The Simrad EK500 Scientific Sounder (v.5.30 firmware) was operated continuously along the cruise tracks and during gear deployments throughout the cruise. EK500 data were collected simultaneously from three hull-mounted transducers (38 and 120 kHz split-beam transducers, and the 12 kHz single-beam transducer) at a ping rate of every 2 seconds. EK500 data from each frequency were simultaneously transmitted to a Sun Sparc 5 workstation and a PC computer for storage and post-processing.

The EK500 data were logged to the Simrad BI500 Bergen Integrator (release 1.9.1996) via TCP/IP ETHERNET line. The EK500 received its navigational input from the Scientific Computer System (SCS) PCODE output. A SUN Sparc workstation operated the Bergen Integrator (BI500) which logged, processed, and archived EK500 data as binary files into the UNIX-based INGRES relational database.

During the cruise, the BI500 post-processor was used to filter unwanted noise (e.g., bottom interference) and partition acoustic backscatter by species composition. Data for all three frequencies were post-processed at sea to remove unwanted noise. When apportioning acoustic backscatter by species, the midwater trawl catches and underwater video observations were used to determine the species composition. The 38 kHz data were apportioned by species, and then the equivalent proportions of backscatter were applied to the 12 and 120 kHz data.

The processed EK500 echogram data were vertically integrated as volume backscatter (S_v in units of m^2/m^3) into 0.5 m depth increments. Volume backscatter were converted to cross-sectional backscatter (S_a in units of m^2/nm^2) as a relative index of abundance along the cruise track. The BI500 scaled these density estimates from m^2/m^2 to nautical mile squared ($m^2/nm^2 = s_a * 1852\ m^2/nm^2$). Individual target strength (TS) measurements were also collected by the EK500. A minimum volume backscatter threshold was set at -66 dB (dB = 10 $\log_{10}(s_v)$) to remove low level acoustic scattering from zooplankton and small non-swimbladdered fish. Data between the surface and the bubble layer were not included in the analysis to eliminate scattering by surface bubbles and noise. The bubble layer was set to 10 m for the 38 and 120 kHz data, and to 32 m for the 12 kHz data due to its significant noise near surface from the "ring-down" of the transducer. The 0.5 m layer along the bottom was also removed during the processing. Indices of relative areal density (S_a in units of m^2/nm^2) were averaged for each 0.5 nautical mile interval along the cruise track. These values were scaled by individual target strength and area to obtain abundance and biomass estimates for the survey area.

The EK500 data (echogram files and the INGRES database) were backed-up and downloaded to a shore-based computer for NEFSC archival. EK500 data were also transmitted to a PC computer using SonarData's EchoLog software package. These data were also downloaded to a shore-based computer at NEFSC for archival and post-processing with SonarData's EchoView software package at a later date.

Scientific Computer System (SCS):

The FRV Delaware's Scientific Computer System (SCS) continuously collected navigational, oceanographic, and meteorological data at a rate of every 30 seconds throughout the cruise track. SCS vessel motion data were collected every second throughout the cruise. The SCS Event Logger program was used throughout the cruise to develop a detailed Eventlog file of dates, times, and positions of each transect waypoint and gear deployment. The Eventlog also contained operational and observational comments. The Eventlog was critical for managing and linking our continuous and deployment type data. The SCS master clock was used to synchronize all data collection by the computers, workstations, and instrumentation.

Midwater Trawl Operations:

The High Speed Midwater Rope Trawl (HSMRT, Gourock design R2028825A) was the main sampling gear used to verify fish backscatter identified by the EK500. The HSMRT is a four seam pelagic trawl design with 53.1 m headrope, footrope, and breastlines. The HSMRT was rigged to 1.8 m^2 double-foiled Suberkrub-type doors with 62.4 m of upper and lower bridles/legs. The optimum tow configuration (2.5 m setback, 227 kg tomweights, intermediate door spread with two shoe weights per door) was implemented during survey operations (refer to Cruise Results DE 98-09 for further details). The vertical and horizontal mouth opening of the HSMRT was typically about 13 ± 3 m and 27 ± 5 m, respectively. HSMRT deployments were targeted on selected fish backscatter along the cruise track. HSMRT deployments were generally conducted about once per watch (i.e., every 6 hours). Deployments served to verify species composition comprising acoustic backscatter based on scattering patterns observed in acoustic echograms. The HSMRT was towed at speeds of 4.0 - 4.5 knots typically for 30 minutes in duration, however the tow duration often varied between 20 to 60 minutes depending on acoustic fish signals observed during the tow. Tow duration was defined as the time between setting the doors below the surface and when doors are hauled out of the water. The tow profiles of the midwater trawling were dropped incrementally through the water column to the desired depth of the scattering layer or when the footrope was about 10-20 m off the bottom. The trawl was held at that selected depth for the duration depending on the fish targets observed by the trawl monitoring system, and then retrieved back to the surface. The trawl was targeted on selected backscattering aggregations observed in the EK500 echograms, bridge sounders, and the real-time display of the FS903 trawl monitoring system. Trawl duration, tow depths, and tow speeds were not standardized or consistent between trawls, therefore catch data should not be used for abundance estimates.

Midwater Trawl Monitoring:

Trawl performance was measured with a FS903 system, ITI system, and a pair of Vemco temperature-depth Minilog sensors. The Simrad ITI wireless trawl sensors were used to obtain point measurements of the trawl depth, vertical opening, wing spread, and door spread. Minilog depth-temperature probes were attached to the trawl headrope and footrope to provide continuous depth-temperature and trawl performance profile data from each deployment. The Simrad FS903 Trawl Monitoring System is a third-wire device that provided real-time sonar images of the trawl opening and performance. The FS903 sonar display showed whether fish were entering or avoiding the trawl opening. This information provided targeted trawling with minimal tow duration to capture only the necessary amount of fish required for scientific samples.

Biological Sampling:

The catch from each trawl was sorted by species, weighed, and measured according to standard NEFSC procedures. Additional biological sampling for target species (e.g., Atlantic herring and mackerel) included individual weights (to nearest 0.1 g), fork and total lengths (nearest mm), and stomach content analyses.

Furuno CSH-5 Omni-directional Sonar:

The Furuno CSH-5 Omni-directional Sonar was used during survey operations for detecting fish schools, locating aggregations, and documenting the horizontal spatial patterns of herring along the transects. The CSH-5 sonar simultaneously scanned a full 360^0 with a cone-shaped receiving beam. Its beam can be tilted at various angles from the surface, and the center of its beam was usually angled 7^0 from the surface during calm weather. During rough weather, the beam tilt angle was set at 10^0 to eliminate surface noise. The vertical width of the receiving beam is 15^0 resulting in a horizontal search radius of 800 m in waters with bottom depths of around 200 m. The search radius on the display was set to 400 m during most of the survey operations. In shallow waters of less than 80 m depth, the search radius was lowered to 250 m. The omni-directional sonar operating at 55-64 kHz was identified as a source of acoustical interference with the EK500 operations during previous cruises, however this problem was eliminated by wiring the external trigger of the omni-directional sonar to the EK500 which controls its ping rate. Analog images from the omni-directional sonar were obtained using a video capture-board every 30 seconds, and the files were merged with the SCS navigational data and archived.

Static Underwater Video System:

The Static Underwater Video System (SUVS) was designed by the NEFSC Fisheries Acoustics Research Group to directly verify acoustic targets within the EK500 beam. The SUVS was deployed midship from the forward A-frame along-side the acoustic beam of the EK500 while the FRV Delaware drifted over selected backscatter aggregations. A pair of underwater video cameras (DSP&L Supercam CCD and MicroSea color 2050) were mounted in the array to obtain video of targets. The MicroSea 2050 cameras has a light sensitivity of 0.05 lux with auto-adjusting with a 77^0 horizontal and 59^0 vertical view field. The Supercam CCD video camera provided low light capability to 0.001 lux. A pair of DSP&L SeaLasers 100-15 were mounted in parallel (54 mm off-center) for measuring target size. Two DSP&L SeaLites provided illumination that could be dimmed remotely using a 120 v voltage regulator. An attached JASCO Attitude sensor provided real-time depth profile, temperature, compass bearing, and three-dimensional orientation of the camera system every 10 seconds. Dual video and environmental data were transmitted and recorded from the SUVS through a 600 m multi-conductor cable via portable winch system to the PC computer and SVHS video recorders. Each video frame was time-stamped with a Horita time-code generator.

RESULTS

EK500 Calibrations:

The original departure time scheduled on February 5 was delayed until February 7 at 15:00 (all dates and times herein are in GMT which was equivalent to local time plus five hours) due to strong winds. Therefore, acoustical calibrations of the Delaware's EK500 scientific echo-sounder were conducted at the pier of the Woods Hole Oceanographic Institute during February 5-6, 2001. The 120 and 38 kHz split-beam transducers were accurately calibrated with high precision, and the existing survey parameter for the transceiver settings remained unchanged given the high precision and consistency of the calibration results. Only the Sv gain for the 38 kHz was slightly modified. The TS gain values for the 12, 38, and 120 kHz were -18.3, -23.28, and -26.2 dB, respectively. The Sv gain values for the 12, 38, 120 kHz were -18.3, -23.1, and -26.1 dB, respectively. The single-beam 12 kHz transducer could not be calibrated due to the difficulties associated with its lack of directionality and large near-field, therefore the existing parameters from the 1997 calibrations were not changed.

Survey Operations:

Survey operations began south of Martha's Vineyard (40057.6'N 70047.3'W) on February 7 at 21:20, and a series of parallel transects were acoustically surveyed using the EK500 along the continental shelf between the depths of 40 and 350 m to just south of the Hudson Canyon region (Fig. 1). Midwater trawling and underwater video deployments were intermittently conducted to identify acoustical backscatter. CTD cast were conducted at the waypoints of each transect and for each gear deployment to define the temperature patterns within the study area.

Survey operations begin on February 7 at 19:27 approximately 25 miles south of Martha's Vineyard (40^{0}57.6'N 70^{0}47.3'W). The survey area included a series of parallel north-south transects along the continental shelf between the depths of 50 and 400 m to about 60 miles southwest of the Hudson Canyon region (Fig. 1). Midwater trawling, underwater video deployments, and CTD casts were conducted at selected locations along the transects to identify acoustical backscatter and describe the hydrographic structure of the study area. Four parallel and three crossover transects (transects 1-7) were completed before survey operations stopped on February 9 at 21:47 due to increasing sea state of over 6 ft.

After an overnight portcall, the FRV Delaware departed Woods Hole on February 12 at 15:00 and begin transect 8 on February 13 at 00:23. The first pass across the survey area from east to west (transects 1-13) was completed on February 15 at 07:56, and the second pass across the survey area from west to east (transects 14-32) was completed during February 21 at 01:05. The transects of the second pass across the survey area were located between the parallel north-south transects of the first pass, resulting in about 10 nautical spacing between the parallel transects (Fig. 1). Transect 33 was a crossover to an experimental transect that was conducted during the night (transect 34) and repeated during the day (transect 35). Cruise operations were completed on February 21 at 17:44 upon the completion of transect 35, and the FRV Delaware headed back to Woods Hole early due to increasing seas. The FRV

Delaware arrived in Woods Hole on February 22 at 00:30, which was about 1.5 days earlier than originally scheduled.

Acoustic observations:

EK500 data provided quantitative estimates of relative fish and squid abundance, however the acoustical data has yet to be partitioned by species. Areal backscatter estimates from the northern inshore portion of the transects appeared to be primarily from Atlantic herring. Atlantic herring were loosely scattered along the bottom during the night and tightly schooled within the water column during the day. A second band of backscatter occurred along the slope region of the survey area. This backscatter appeared to be mainly small *Loligo* squid along the shelf-break and an aggregation of scup just south of Hudson Canyon.

The EQ50 provided interesting acoustical information that could increase our capabilities of species classification, particularly the 200 kHz data. The 200 kHz provided enhanced resolution, and allowed provided individual discrimination of herring and squid targets. The 50 kHz data can also provide useful results that can be used to inter-calibration NEFSC cooperative acoustic surveys with the Canadian and Maine Department of Marine Resource acoustic operations. Unfortunately, the EQ50 model only provide analog information and does not provide digital data output for scientific use. It is recommended that the EQ50 be replaced by the EQ60 (or preferably EK60) to provide digital output to meet the purpose of navigational and scientific objectives.

Midwater Trawl Operations:

The northern boundary of the study area was delimited by the 50 m depth contour which was regarded as the shallowest depth that the HSMRT midwater trawl could be deployed. One midwater trawl deployment (deploy # 34) was unsuccessfully attempted in water with 34 m depth. During that tow, the doors either planed on the surface with too little wire-out or came too close to bottom. Trawling in shallow waters also restricted the door spread and net opening due to the reduced wire-out. For example, a wire-out of 175 m at a tow speed of 4.0 knots resulted in the headrope depth at about 44 to 50 m depth (scope ranging 3.9:1 to 3.5:1). This shallow water tow configuration usually resulted in an average door spread, wing spread, and vertical opening measurements of 44, 24, and 8 m, respectively. Increased wire-out of 200 m resulted in a headrope depth of 62 m (scope 3.2:1) at 4.0 knots with an increase in the trawl opening (average door spread, wing spread, vertical opening of 50, 28, 8.6 m, respectively). In comparison to a deep water tow configuration at 4.0 knots, the wire-out of 450 m generally resulted in the headrope settling at 145 m depth (scope 3.1:1). This increased wire-out in deeper water allowed the trawl to fully open with door spread, wing spread, and vertical opening measurements averaging 67 ± 3, 33 ± 3, 9 ± 1.5 m, respectively. In comparison to previous surveys, the average vertical opening during this cruise dropped about 4 m because the tomweights were reduced from 700 to 600 lbs. The tomweights should be increased to no less than 700 lbs for future surveys to achieve an optimal opening.

Midwater Trawl Catch:

A total of 20 midwater trawl deployments were completed during the cruise, of which one trawl deployment (trawl 34) was aborted due to shallow water depths of 34 m. The predominant pelagic species captured during midwater trawl operations was Atlantic herring (Table 1). The largest catch of herring occurred in trawl 54. The occurrence of pelagic fish and squid species in the bottom trawl catches from the FRV Albatross were in some agreement with the results from the FRV Delaware's midwater trawl and acoustic observations. For example, Atlantic herring were distributed throughout the survey area along the northern half of the transects in the cooler (4-7^{0}C) waters (Fig. 1, 2, and 3). In contrast, *Loligo* squid was the second most common pelagic species captured, and appeared to be distributed in the warmer (9-12^{0}C) waters along the slope. Trawl catches not only verified Atlantic herring and *Loligo* squid backscatter aggregations, an aggregation of scup along the slope just south of Hudson Canyon (trawls 25 and 38) provided distinctive backscatter observations. Atlantic mackerel were captured only once (trawl 54) during the cruise, however there may have been mackerel schools observed acoustically along the 9^{0}C isotherm that could not be captured by the midwater trawl. Another interesting observation occurred during the last trawl (deployment 67) where Atlantic herring and blueback herring were captured. Acoustical measurements suggested that there may have been behavioral differences during the night between these two Clupeid species. For example, Atlantic herring appeared to be loosely scattered along the bottom at night while blueback herring seem to be tightly schooled in the water column.

Underwater CCD Video Observations:

Four underwater video deployments (deploy # 15, 47, 55, 58) were conducted on herring aggregations. Atlantic herring were observed during the first three underwater video deployments which were conducted during the night, while herring were not successfully observed with the forth video deployment conducted the day. Backscatter indicated that herring were scattered throughout the water column in tight small schools during the day. During the night, herring were observed to be loosely aggregated along the bottom depth layer (typically 10-20 m from the bottom). Lights were required during the night observation which generally resulted in the avoidance of herring and euphausiids from the video camera. When lights were turned off, acoustical backscatter re-aggregated within 2-3 minutes and lights were then turned back on to obtain the herring observations. Although the CCD camera (light sensitivity of 0.001 lux) provided good resolution during the day at 70 m depth without lights, lights were required during the night. Therefore, it is recommended that SIT (rather than CCD) underwater camera technology be implemented in future studies to eliminate the avoidance problems from using lights at night. Although the JASCO motion sensor provided pitch, roll, heave, and compass bearing of the underwater video, its real-time depth sensor was not operational due to internal wiring problems. Depth-temperature profiles were obtained from the Minilog probes during the video observations. Another problem to resolve is that the camera also occasionally oriented backwards to the drift resulting in less observations, which emphases the need to redesign the camera tow-body into a more fusiform shape for improved orientation and stealthiness. Further to Table 2 for deployment eventlog.

DISPOSITION OF DATA

All data and results are archived at the Northeast Fisheries Science Center, and will be available through the NEFSC Oracle data management system.

SCIENTIFIC PERSONNEL

National Marine Fisheries Service, NEFSC, Woods Hole, MA

William Michaels	Chief Scientist	Parts I, II
Michael Jech	Research Fisheries Biologist	Parts I, II
Thomas Azarovitz	Research Fisheries Biologist	Part I
Roger Clifford	Gear Specialist	Part II

PTSI Contractors, NEFSC, Woods Hole, MA

Kara Dwyer	Bioacoustical Technician	Parts I, II
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Contractors, Fisheries Observer Program, NEFSC, Woods Hole, MA

Ragan Elsemore	Fisheries Observer	Parts I, II
Michael Michaelski	Fisheries Observer	Part I

Contractor, Chilsbury, MA

Tal Gregory	Student Volunteer	Part II

An exchange of scientific staff resulted in the above designation of two parts:

Part I	during February 7 - 9, 2001
Part II	during February 12 - 23, 2001

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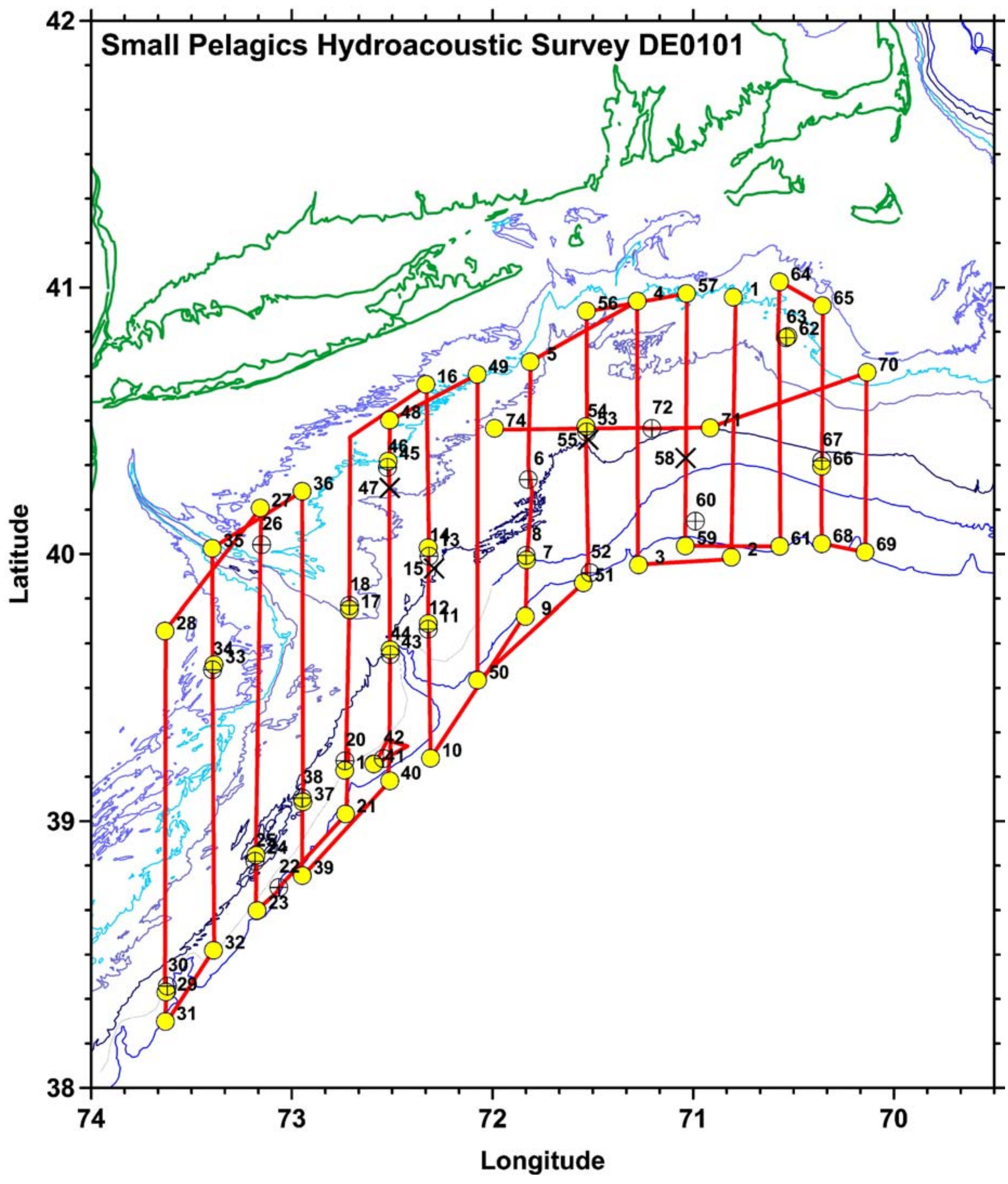

Figure 1. Acoustical transects and deployment locations (CTD, underwater video, and midwater trawl deployments are indicated with circles, crosses, and circles with crosses) for the Small Pelagics Hydroacoustic Survey (cruise number DE 01-01) during February 7 - 21, 2001.

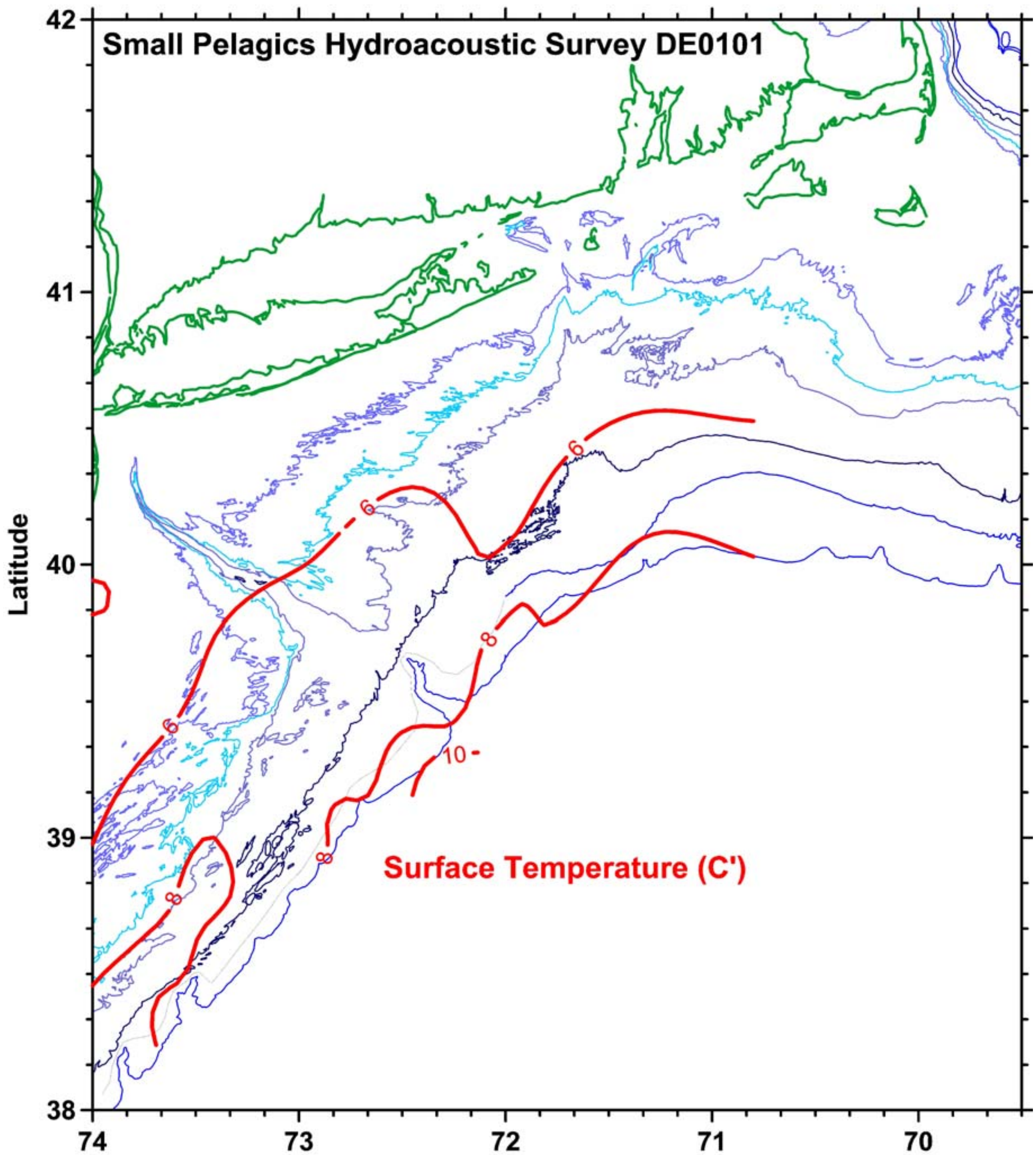

Figure 2. Surface temperatures during the Small Pelagics Hydroacoustic Survey (cruise number DE 01-01) during February 2001. Data were derived from SCS 2 m hull temperature probe from the FRV Delaware (cruise number DE 01-01) and FRV Albatross (cruise number DE 01-01).

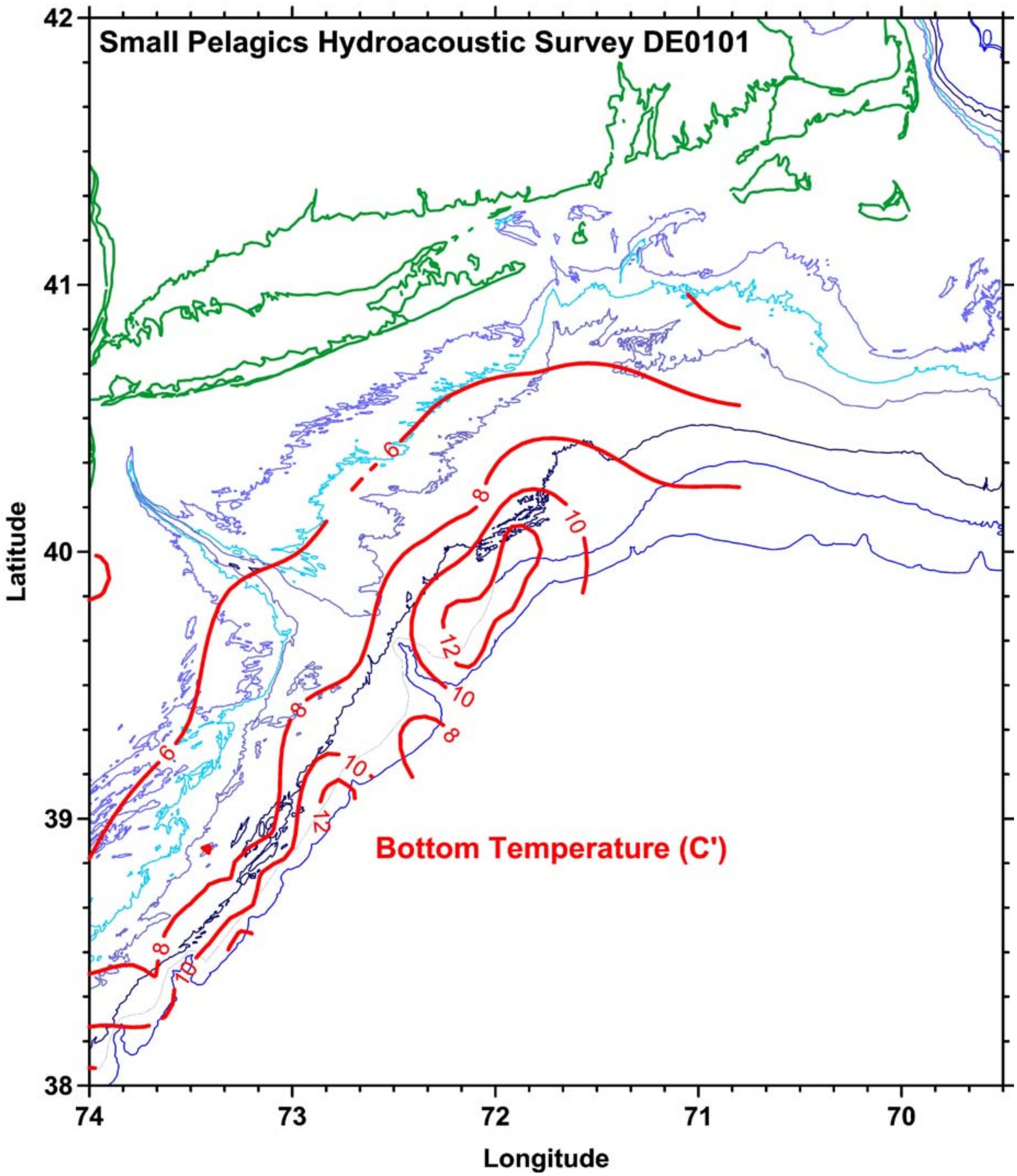

Figure 3. Bottom temperatures during the Small Pelagics Hydroacoustic Survey (cruise number DE 01-01) during February 2001. Data were derived from CTD casts from the FRV Delaware (cruise number DE 01-01) and FRV Albatross (cruise number DE 01-01).

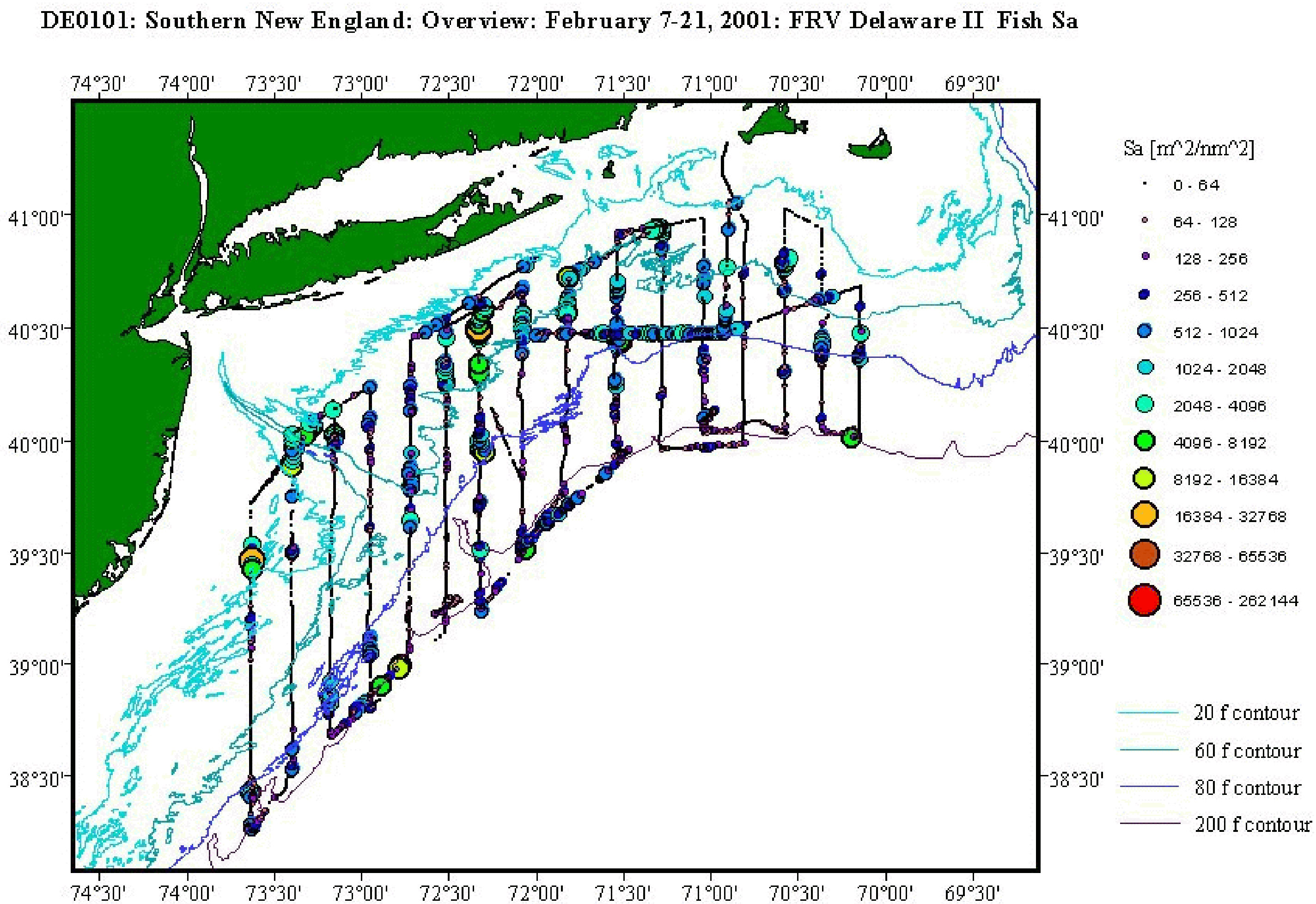

Figure 4. Areal backscatter estimates for fish and squid from the Small Pelagics Hydroacoustic Survey (cruise number DE 01-01) during February 2001.

Table 1. Total number of pelagic fish and squid captured in each midwater trawl deployment during the Small Pelagics Hydroacoustic Survey (cruise number DE 01-01) by species code. The species codes are: 15 spiny dogfish, 32 Atlantic herring, 33 alewife, 72 silver hake, 121 Atlantic mackerel, 131 butterfish, 143 scup, 172 striped searobin, 502 *Illex* squid, and 503 *Loligo* squid. The other species heading includes pearlsides, *Rossia* squid, *Stoloteuthis leucoptera*, *Semirossi tenera*, lumpfish, northern searobin, and sea lamprey.

Deploy #	15	32	33	34	72	121	131	143	172	502	503	Other
008	0	0	0	0	0	0	1	0	0	0	13	0
012	0	0	0	0	0	0	1	0	0	0	18	0
014	0	0	1	0	0	0	0	0	0	0	4	0
018	0	0	0	0	0	0	0	0	0	0	15	2
020	0	0	0	0	0	0	2	0	0	0	1	0
022	0	0	0	0	0	0	0	0	0	0	1	1
025	0	0	0	0	0	0	0	3	0	0	22	1
026	1	72	0	0	0	0	0	0	0	0	9	0
030	0	0	0	0	0	0	0	0	10	0	48	0
038	2	0	0	0	0	0	0	14	16	0	25	1
042	0	0	0	0	0	0	0	0	0	0	10	0
044	0	0	0	0	0	0	0	0	0	0	9	0
046	0	46	1	0	1	0	0	0	0	0	3	0
052	0	0	0	0	0	0	0	0	0	0	0	4
054	0	1092	0	0	0	17	0	0	0	0	16	0
060	0	0	0	0	0	0	0	0	0	0	2	1
063	0	76	0	0	2	0	0	0	0	0	0	9
067	0	3	0	24	0	0	0	0	0	0	0	0
072	0	192	0	1	4	1	0	0	0	0	2	2
total =	3	1481	2	25	7	18	4	17	26	0	198	21

Table 2. Eventlog for HSMRT trawl, CTD, and underwater video deployments conducted during Small Pelagics Hydroacoustics Survey (cruise DE 01-01). Time is in GMT.

Site	Transect	Deployment	Series	Gear	B_Date	B_Time	B_Lat	B_Lon	B_Vlog	E_Date	E_Time
S_New_Engl		1	syspl01	CTD	2/7/01	20:03:48	40 57.80	-70 47.95	38.60	2/7/01	20:09:08
S_New_Engl	1	2	syspl01	CTD	2/8/01	3:12:55	39 59.57	-70 48.66	98.30	2/8/01	3:43:02
S_New_Engl	2	3	syspl01	CTD	2/8/01	5:59:46	39 57.58	-71 16.33	120.60	2/8/01	6:17:30
S_New_Engl	3	4	syspl01	CTD	2/8/01	12:27:51	40 56.93	-71 16.70	181.40	2/8/01	12:28:18
S_New_Engl	4	5	syspl01	CTD	2/8/01	15:35:17	40 43.30	-71 48.71	209.98	2/8/01	15:43:15
S_New_Engl	5	6	syspl01	HSMRT	2/8/01	18:44:02	40 16.77	-71 49.30	236.55	2/8/01	19:05:27
S_New_Engl	5	7	syspl01	CTD	2/8/01	21:08:46	39 58.66	-71 49.85	255.45	2/8/01	21:15:00
S_New_Engl	5	8	syspl01	HSMRT	2/8/01	21:39:42	39 59.70	-71 49.95	256.78	2/8/01	22:38:35
S_New_Engl	5	9	syspl01	CTD	2/9/01	0:51:53	39 46.09	-71 50.09	281.69	2/9/01	1:12:54
S_New_Engl	6	10	syspl01	CTD	2/9/01	4:51:17	39 14.12	-72 18.44	320.78	2/9/01	5:12:19
S_New_Engl	7	11	syspl01	CTD	2/9/01	8:15:59	39 44.51	-72 19.16	351.57	2/9/01	8:23:07
S_New_Engl	7	12	syspl01	HSMRT	2/9/01	8:49:24	39 43.20	-72 19.23	353.13	2/9/01	9:25:09
S_New_Engl	7	13	syspl01	CTD	2/9/01	11:45:59	40 01.44	-72 19.23	378.40	2/9/01	11:52:13
S_New_Engl	7	14	syspl01	HSMRT	2/9/01	13:29:06	39 57.15	-72 19.00	384.00	2/9/01	14:59:21
S_New_Engl	7	15	syspl01	VIDEO	2/9/01	15:50:42	39 56.76	-72 17.47	390.70	2/9/01	16:40:03
S_New_Engl	7	16	syspl01	CTD	2/9/01	21:43:08	40 38.20	-72 19.94	434.59	2/9/01	21:47:52
S_New_Engl	9	17	syspl01	CTD	2/13/01	6:31:45	39 47.58	-72 42.77	520.34	2/13/01	6:36:52
S_New_Engl	9	18	syspl01	HSMRT	2/13/01	7:37:22	39 48.46	-72 42.76	524.94	2/13/01	8:32:00
S_New_Engl	9	19	syspl01	CTD	2/13/01	12:48:45	39 11.51	-72 44.02	571.00	2/13/01	13:00:39
S_New_Engl	9	20	syspl01	HSMRT	2/13/01	13:37:44	39 13.55	-72 44.12	573.40	2/13/01	14:24:05
S_New_Engl	9	21	syspl01	CTD	2/13/01	16:21:02	39 01.86	-72 43.80	593.70	2/13/01	16:52:00
S_New_Engl	10	22	syspl01	HSMRT	2/13/01	19:24:43	38 45.09	-73 03.87	619.00	2/13/01	20:17:29
S_New_Engl	10	23	syspl01	CTD	2/13/01	22:05:20	38 39.87	-73 10.47	635.81	2/13/01	22:14:23
S_New_Engl	11	24	syspl01	CTD	2/13/01	23:36:05	38 52.34	-73 10.62	648.83	2/13/01	23:43:14
S_New_Engl	11	25	syspl01	HSMRT	2/14/01	0:08:02	38 51.01	-73 11.02	650.42	2/14/01	0:49:39
S_New_Engl	11	26	syspl01	HSMRT	2/14/01	8:47:56	40 02.12	-73 09.04	732.93	2/14/01	9:22:51
S_New_Engl	11	27	syspl01	CTD	2/14/01	11:12:47	40 10.35	-73 09.37	749.70	2/14/01	11:17:24
S_New_Engl	12	28	syspl01	CTD	2/14/01	20:22:06	39 42.77	-73 37.84	828.99	2/14/01	20:25:48
S_New_Engl	13	29	syspl01	CTD	2/15/01	4:17:14	38 21.45	-73 37.76	910.53	2/15/01	4:32:29
S_New_Engl	13	30	syspl01	HSMRT	2/15/01	4:54:59	38 22.92	-73 37.29	912.21	2/15/01	5:51:30
S_New_Engl	13	31	syspl01	CTD	2/15/01	8:03:37	38 14.97	-73 37.75	932.49	2/15/01	8:25:37
S_New_Engl	14	32	syspl02	CTD	2/15/01	10:27:07	38 30.96	-73 23.42	952.99	2/15/01	10:36:06
S_New_Engl	15	33	syspl02	CTD	2/15/01	16:58:26	39 35.25	-73 23.74	1017.86	2/15/01	17:00:45
S_New_Engl	15	34	syspl02	HSMRT	2/15/01	17:21:54	39 34.10	-73 23.70	1019.06	2/15/01	17:38:49
S_New_Engl	15	35	syspl02	CTD	2/15/01	20:57:02	40 01.30	-73 23.81	1051.25	2/15/01	21:03:33
S_New_Engl	16	36	syspl02	CTD	2/15/01	23:30:37	40 14.13	-72 56.90	1075.91	2/15/01	23:37:06

Table 2. Cont.

Site	Transect	Deployment	Series	Gear	B_Date	B_Time	B_Lat	B_Long	B_Vlog	E_Date	E_Time
S_New_Engl	17	37	syspl02	CTD	2/16/01	6:20:50	39 04.35	-72 56.68	1146.19	2/16/01	6:26:58
S_New_Engl	17	38	syspl02	HSMRT	2/16/01	6:45:21	39 05.22	-72 56.89	1147.25	2/16/01	7:20:34
S_New_Engl	17	39	syspl02	CTD	2/16/01	9:51:03	38 47.78	-72 56.87	1172.79	2/16/01	10:10:07
S_New_Engl	18	40	syspl02	CTD	2/16/01	13:22:08	39 09.03	-72 30.75	1203.27	2/16/01	14:03:18
S_New_Engl	20	41	syspl02	CTD	2/16/01	16:14:11	39 12.79	-72 35.21	1226.48	2/16/01	16:38:02
S_New_Engl	20	42	syspl02	HSMRT	2/16/01	17:31:30	39 14.11	-72 32.71	1229.62	2/16/01	18:46:22
S_New_Engl	19	43	syspl02	CTD	2/16/01	21:29:05	39 38.70	-72 30.57	1259.46	2/16/01	21:36:47
S_New_Engl	19	44	syspl02	HSMRT	2/16/01	21:58:25	39 37.55	-72 30.56	1260.85	2/16/01	22:45:32
S_New_Engl	19	45	syspl02	CTD	2/17/01	3:49:31	40 20.87	-72 31.15	1313.11	2/17/01	3:54:57
S_New_Engl	19	46	syspl02	HSMRT	2/17/01	4:22:41	40 19.54	-72 31.44	1314.72	2/17/01	5:05:51
S_New_Engl	19	47	syspl02	VIDEO	2/17/01	5:51:18	40 14.90	-72 30.72	1319.68	2/17/01	6:47:18
S_New_Engl	19	48	syspl02	CTD	2/17/01	8:24:56	40 30.16	-72 30.81	1336.25	2/17/01	8:28:48
S_New_Engl	21	49	syspl02	CTD	2/17/01	10:49:26	40 40.39	-72 04.54	1360.28	2/17/01	10:55:14
S_New_Engl	22	50	syspl02	CTD	2/18/01	16:18:37	39 31.91	-72 04.51	1458.72	2/18/01	16:44:29
S_New_Engl	23	51	syspl02	CTD	2/18/01	20:09:10	39 53.50	-71 32.86	1492.34	2/18/01	20:23:56
S_New_Engl	24	52	syspl02	HSMRT	2/18/01	22:01:50	39 55.80	-71 30.78	1506.47	2/18/01	22:45:55
S_New_Engl	24	53	syspl02	CTD	2/19/01	2:50:49	40 28.70	-71 32.13	1547.29	2/19/01	2:57:46
S_New_Engl	24	54	syspl02	HSMRT	2/19/01	3:20:22	40 27.53	-71 31.81	1548.64	2/19/01	4:05:13
S_New_Engl	24	55	syspl02	VIDEO	2/19/01	5:52:27	40 25.74	-71 31.41	1556.82	2/19/01	6:56:21
S_New_Engl	24	56	syspl02	CTD	2/19/01	9:41:23	40 54.69	-71 31.90	1586.96	2/19/01	9:45:08
S_New_Engl	25	57	syspl02	CTD	2/19/01	11:57:29	40 58.64	-71 02.05	1610.04	2/19/01	12:02:19
S_New_Engl	26	58	syspl02	VIDEO	2/19/01	16:19:03	40 21.55	-71 02.28	1652.58	2/19/01	17:32:29
S_New_Engl	26	59	syspl02	CTD	2/19/01	19:33:14	40 01.84	-71 02.32	1673.90	2/19/01	19:50:05
S_New_Engl	26	60	syspl02	HSMRT	2/19/01	20:57:37	40 07.41	-70 59.34	1682.01	2/19/01	22:08:10
S_New_Engl	27	61	syspl02	CTD	2/20/01	0:53:46	40 01.69	-70 34.20	1711.85	2/20/01	1:06:20
S_New_Engl	28	62	syspl02	CTD	2/20/01	5:53:52	40 48.96	-70 31.70	1761.73	2/20/01	5:57:24
S_New_Engl	28	63	syspl02	HSMRT	2/20/01	6:38:21	40 48.69	-70 32.23	1764.60	2/20/01	7:18:01
S_New_Engl	28	64	syspl02	CTD	2/20/01	9:09:57	41 01.24	-70 34.11	1783.25	2/20/01	9:14:25
S_New_Engl	29	65	syspl02	CTD	2/20/01	10:23:02	40 55.89	-70 21.41	1794.23	2/20/01	10:26:18
S_New_Engl	30	66	syspl02	CTD	2/20/01	15:24:18	40 19.76	-70 21.67	1837.89	2/20/01	15:34:51
S_New_Engl	30	67	syspl02	HSMRT	2/20/01	15:53:43	40 21.02	-70 21.51	1839.37	2/20/01	17:04:35
S_New_Engl	30	68	syspl02	CTD	2/20/01	19:53:42	40 02.33	-70 21.56	1867.44	2/20/01	20:06:04
S_New_Engl	31	69	syspl02	CTD	2/20/01	21:13:43	40 00.51	-70 08.60	1877.80	2/20/01	21:21:45
S_New_Engl	32	70	syspl02	CTD	2/21/01	1:08:58	40 40.88	-70 08.08	1916.55	2/21/01	1:13:01
S_New_Engl	33	71	drnpl03	CTD	2/21/01	5:05:43	40 28.42	-70 54.97	1954.40	2/21/01	5:10:18
S_New_Engl	34	72	drnpl03	HSMRT	2/21/01	7:00:09	40 28.27	-71 12.34	1970.55	2/21/01	7:41:36
S_New_Engl	34	73	drnpl03	CTD	2/21/01	12:24:52	40 28.00	-72 00.02	2016.79	2/21/01	12:29:53
S_New_Engl	34	74	drnpl03	CTD	2/21/01	12:49:41	40 28.25	-71 59.53	2017.32	2/21/01	12:55:51